

REMARKS

Claims 8-16, 21-30 and 32 are presently pending. Claims 14-16, 22-24 and 28-30 have been withdrawn from consideration. Claims 8-13, 21, 25-27 and 32 have been rejected. No claims have been amended, canceled or added herein.

I. Claim Rejections under 35 U.S.C. § 103

Claims 8-13, 21, 25-27 and 32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,358,627 to Benenati, et al. (“Benenati”) alone. In particular, the Office Action states, “Benenati discloses . . . a plurality of solder bumps 20 (fig. 6a) . . . and a single support coating . . . [that] has been fully cured . . . prior to any reflow of any of said . . . solder bumps.” The Office Action also states, “it would have been obvious . . . to modify the invention of Buchwalter [sic] with a specific range for the support coating’s height relative to the bumps.” Applicants respectfully traverse these rejections.

Applicants respectfully submit that a *prima facie* case of obviousness has not been made for several reasons. To establish a *prima facie* case of obviousness, a given prior art reference must teach or suggest all claim limitations. *See, e.g.*, MPEP § 2143. In addition, there must be a reasonable expectation of success when making a proposed modification to the prior art. *See id.* Furthermore, there must be some suggestion or motivation, either in the prior art itself or in the knowledge generally available to one of ordinary skill in the art, to modify a reference. *See id.* Applicants respectfully submit that none of these three requirements are met by the obviousness rejections as set forth in the Office Action.

All Claim Limitations Not Within The Prior Art

In order to render a claim as obvious, a reference must contain or suggest every material element of that claim. *See* MPEP § 2143. Yet, several material claim elements are simply not present in or suggested by Benenati, the only prior art reference that has been used

for all rejections. For example, independent claims 8, 13 and 32 all recite the element of “a plurality of solder bumps.” Because these are the only pending independent claims, all claims require this element of a plurality of solder bumps. Conversely, Benenati does not disclose a plurality of solder bumps. Rather, Benenati teaches a “conductive ball 20” that does not function as a typical solder bump, but instead rolls when the electrical components it connects move at different rates due to thermal expansion. “Conductive ball 20 can be a solid metal ball, formed of a material such as gold or copper.” Benenati, at col. 3 lines 51-52. Also, “conductive ball 20 can roll or otherwise move through conductive paste 22. . . . Ball 20 rolls as chip 26 and substrate 28 move.” Benenati, at col. 4 lines 15-24. Because Benenati does not teach a plurality of solder bumps, and because all pending claims require this element of a plurality of solder bumps, Applicants respectfully submit that the pending obviousness rejections fail for at least this reason alone.

Furthermore, independent claim 8 recites a “single support coating [that] has been fully cured prior to any reflow of said plurality of solder bumps,” independent claim 13 recites a “support coating [that] is sufficiently rigid such that it is suitable for significantly constraining portions of the solder bumps near the bump to die interfaces during a subsequent reflow of said plurality of solder bumps,” and independent claim 32 recites, “a support coating formed on said active surface of said die such that mid-level wetting angles are formed at mid-level junctions where the upper surface of said support coating meets said solder bumps.” Because claims 8, 13 and 32 are the only independent claims, all claims require some form of support coating. Applicants respectfully submit that Benenati does not teach a support coating, much less one that meets these limitations. Rather, Benenati teaches a plurality of individual applications of a “conductive paste 22” that function to provide electrical contacts between conductive balls 20 and contact pads 24, 27. “Conductive ball 20 *can roll or otherwise move through* conductive paste 22.” Benenati, at col. 4 lines 15-16

(emphasis added). As such, these plural applications of a conductive paste *do not provide support* to the conductive balls, and thus do not comprise a “support coating” as is presently claimed. In addition, the language regarding the support coating in each claim contemplates a reflow of solder bumps, which reflow cannot occur in Benenati for its conductive balls to remain mobile. Because Benenati does not teach a support coating adapted for the context of a reflow of solder bumps, much less a support coating in any context, and because all pending claims require this element of a support coating, Applicants respectfully submit that the pending obviousness rejections also fail for at least this reason alone.

Still further, each of independent claims 8, 13, and 32 recites the limitation “wherein the height of said [] support coating is from about 20 percent to about 70 percent of the pre-reflow height of said solder bumps.” Applicants respectfully submit that Benenati does not teach or suggest any support coating, much less one that meets any of the height limitations present in the pending claims. Additional observations with respect to no expectation of success or motivation to modify Benenati are provided in greater detail below. Regarding the ongoing allegations in the Office Action that Applicants have not established any criticality for the claimed dimensions, Applicants respectfully incorporate all remarks from prior Responses that fully address this issue. As noted previously and in greater detail, significant portions of the written description and figures as filed are devoted toward the criticality of providing a support coating having a specific height range with respect to the solder bumps. In particular, paragraphs 0039 through 0041 and FIGS. 5A through 7B of the application as originally filed directly address the need for specific height ranges for the support coating. Because Benenati does not teach a support coating having a height from about 20 percent to about 70 percent of the pre-reflow height of any solder bumps, and because all pending claims require this element of a support coating height, Applicants respectfully submit that the pending obviousness rejections also fail for at least this reason alone.

No Reasonable Expectation of Success In Modifying The Prior Art

Although the Office Action states, “Buchwalter does not explicitly teach the height of the support coating 22 is about 20-70 percent of the pre-reflow height of the solder bumps 20,” Applicants assume that Benenati is the intended reference in this passage. Applicants agree that Benenati does not teach a support coating having this height range, and again assert that Benenati does not teach a support coating at all. Assuming, *arguendo*, that the individual applications of conductive paste 22 might somehow comprise a support coating, Applicants respectfully submit that there would be no reason to raise the height of this conductive paste to the ranges claimed by Applicants. A prior art reference must be considered in its entirety, including portions that would lead away from the claimed invention. *See*, MPEP § 2141.02. As taught by Benenati, the function of its conductive paste 22 is to facilitate an electrical contact between the conductive ball 20 and pad 27, while at the same time permitting the conductive ball to roll or move freely. Any increase in the amount or height of conductive paste beyond that which is needed to facilitate electrical contact would not only be wasteful, but might also hinder the mobility of the conductive ball. A such, any suggestion that it would be obvious to raise the height of the conductive paste of Benenati would fly in the face of that which is taught by the reference.

Furthermore, the function of the claimed support coating is to *support* a solder bump, and thereby prevent or limit any solder bump movement. Too much movement of the solder bumps in the claimed invention result in cracking and failure, which is the very nature of the problem that the claimed support coating is intended to prevent. To the extent that any proposed modification to the teachings of Benenati would result in an increased amount of conductive paste that might prevent or limit movement of its conductive ball, this would result in the detriment of the overall intentions and teachings of Benenati. Accordingly, there is no reasonable expectation of success in Benenati if this reference were to be modified in

the manner proposed. As such, Applicants respectfully submit that the pending obviousness rejections also fail for this reason alone.

No Motivation To Modify In The Prior Art

As noted previously, Benenati never teaches or suggests a support coating or solder bumps at all, much less a support coating having a height of about 20 percent to about 70 percent of the pre-reflow height of any respective solder bumps. Again, Benenati teaches of a conductive ball that is designed to move and roll about, and not reflow like a conventional solder bump. As such, unlike the case of a conventional solder bump, there is fundamentally no reason to provide any support to prevent the shearing or cracking of this non-stationary conductive ball due to any thermal expansion in the components that it electrically couples. As such, it seems clear that there is no such motivation in the prior art itself. In addition, the Office Action does not point to any motivation within the prior art itself for making any of the proposed modifications. Because there is no motivation to modify the prior art within the prior art itself, Applicants respectfully submit that the pending obviousness rejections also fail for at least this reason alone.

For at least each of the foregoing reasons, it is respectfully submitted that none of the pending claims are rendered as obvious by Benenati. Accordingly, Applicants respectfully request that the pending obviousness rejections be withdrawn.

CONCLUSION

Applicants respectfully submit that all claims are in proper form and condition for patentability, and thus request a Notification of Allowance to that effect. It is believed that no fees are due at this time. If any fees are due in connection with this Response or for this application in general, however, then the Commissioner is hereby authorized to charge such fees to Deposit Account No. 50-0388, referencing Docket No. NSC1P131X3. If there are any questions or issues remaining, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number listed below.

Respectfully Submitted,
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